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PRODUCTION AND UTILIZATION OF PEAT IN HUNGARY

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The article below, apparently a lecture delivered by the author, is followed by comments by other experts in peat mining, refining, and utilization.

Besides the statement that Hungary's peat resources (located in the trans-Danubian region and in the vicinity of Kalocsa) are very small and of inferior grade, the discussion highlighted several other facts: (1) peat coking is to supply Hungary's charcoal requirements, which will amount to 4,000 to 5,000 carloads in 1954; (2) extensive studies have been conducted by several Hungarian research institutes on the utilization of peat derivatives; and (3) it is proposed to utilize the derivatives partly in agriculture (soil improvement, manure production, and plant parasite destruction) and partly in industry (manufacture of sugar and of insulating materials for the building industry).

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Statistical data available reveal that the world has a very substantial peat supply, and that the Soviet Union possesses greater peat reserves than any other country. The following table shows the peat resources of some of the world's larger producers. However, this tabulation is not complete; peat bogs of considerable extent are found especially in countries outside of Europe.

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Table 1

	Survey Year	Million Tons
Soviet Union	1933	70,000 -190,000
Canada	1906	40,000
United States	1906	12,000
Germany	1922	10,000
Sweden	1933	9,000
Poland	1934	5,500
Ireland	1906	4,800
Estonia	1925	2,030
France	1941	2,000
Lithuania	1934	1,665
Scotland	1947	1,000
Hungary	1932	53.55
Denmark	1913	240

In this table Hungary's peat resources are shown to be 53.55 million tons; however, 25 percent must be deducted as a result of the loss sustained in the mining process. According to 1951 statistics, the peat resources of Hungary are located in the peat zones listed in Table 2. It should be pointed out that one cubic meter of raw peat contains dried peat with a moisture content of between 25 and 30 percent.

Table 2

	Millions Cubic Meters
Sarret, Nadasladany	33
Nagyberek	49
Kis Balaton	138
Szigliget-Tapolca	42
Hansag	26
Kaposvolgy	15
Kalocsa region	24
Marcal River Valley	18
Kisvarda	8
Total deposits of smaller regions	4
Total	357

Peat-research activities in Hungary were begun about 3 years ago with the establishment of the Peat Research Institute on 1 June 1948.

Studies conducted by the institute revealed that the findings established by former surveys must be corrected, because certain sections of the peat bogs have been exploited since a survey made 40 years ago; consequently, peat available from these areas has been lost for future utilization.

Qualitative analysis revealed that the various domestic peats are inevitably subsoil layers, with 60 to 70 percent of the substance decomposed and only 30 to 40 percent fibrous peat. It was further established that the peat in more than 90 percent of the domestic peat bogs has a high ash content and that hardly 10 percent has an ash content of less than 10 to 12 percent in air-dried condition.

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Complying with an order issued by higher authorities, the Peat Research Institute discontinued its activities in mid-1949 and the research work initiated by the institute was transferred to the Research Institute for the Heavy Chemical Industry and the Mining Research Institute.

The most primitive methods are employed in Hungarian peat production at present. In nearly all the peat areas currently being worked the peat is brought to the surface by manual labor, but even where machinery is used the equipment is obsolete and more than 40 years old.

Large-scale production, developed in the Soviet Union and known in Hungary as hydropeat production, cannot be used because of the slight yield of the domestic peat bogs. However, the same object may be accomplished by producing so-called "marttozeg" (decayed peat) or by introducing simple or combination conveyer-dredges. Mechanizing the production process would not only solve the problem of labor scarcity, but would also yield a larger amount of peat at a lower cost.

Utilization of peat as a fuel is warranted only in countries where vast peat resources are available or more effective fuels cannot be readily transported. The USSR is such an example. In 1913, Russia produced 1.7 million tons of peat. In contrast, by the end of the Fourth Five-Year Plan the amount of peat to be produced for use as fuel is estimated at 44,300,000 tons.

The foregoing data do not indicate, however, whether the peat is dry or raw peat. If the figures apply to dry peat, then the amount produced in the final year of the Fourth Five-Year Plan in the Soviet Union will equal an amount which would exhaust Hungarian peat deposits in not quite 2 years.

The problem of coking domestic peats has already been studied in the Peat Research Institute. However, these experiments have not progressed beyond the laboratory stage. Experiments along broad lines have been initiated only within the framework of the Research Institute for the Heavy Chemical Industry.

Laboratory experiments have established that peat coal or coke of good quality can be produced only by selecting peat suitable for this purpose and by converting it into machine peat. Machine peat is made from freshly mined peat of low quality. It is a known fact that peat substances undergo such far-reaching changes during the peat-manufacturing process that the original granules can no longer be recognized in the substance and that the cohesion of microscopic peat granules is expedited by pectic substances dissolved from the peat, as well as by the cohesive properties of the peat.

Whenever possible, the initial basic substance should be peat of low ash content. Taking the domestic conditions into consideration, substances with an ash content not exceeding 10 to 12 percent (calculated under atmospheric drying conditions) should be selected.

The purpose of peat coking is to supply domestic raw materials which will satisfy Hungarian charcoal requirements. These requirements will amount to approximately 4,000 to 5,000 carloads in the fifth year of the Five-Year Plan and the bulk of this total must be imported.

Plans for equipping a small-scale peat-distilling establishment were formulated as early as 1949. Preliminary studies indicated that, due to reasons of economy as well as of technology, distilling by internal heating (flush gas system) is preferable to distilling by external heating.

The experimental generating plant of the Municipal Gasworks in Obuda was converted into a distilling plant using flush gases. In the technical execution of the experiment Karoly Koller's flush-gas distilling system was employed. The distillation experiments were started in August 1951, and are now being evaluated.

The distilling shaft consists of an insulated cylinder with a diameter of 900 millimeters and a length of 2,200 millimeters. The loading funnel is located at the top of the cylinder, while the coke-removing equipment with a revolving plate is attached to the lower end. The preheated flush gas penetrates into the distilling shaft through the insulated conduit to a distance approximately one third the length of the distilling shaft; here it is brought into direct contact with the substance to be distilled. Gases thus produced should furnish enough heat for the distilling process; some of these gases are conducted directly into the feed tube of the distilling shaft, while most of the others, after having been preheated in a regenerator, are carried through the same tube into the distilling area.

There was only one defect in the equipment used: because of local conditions, it was impossible to install a preheating space between the loading funnel and the distilling shaft. Such an installation would have made it possible to separate the gas produced during the predistillation of the air-moist peat from the more valuable gases obtained during the distilling process.

Approximately 160 kilograms per hour are fed into the system. The peat thus loaded remains in the distilling equipment for about 11 hours, from time of loading to removal. Machine peat of good quality, dried in the open air (such as the machine peat from Kalocsa), retained its shape during the distilling process, but became finely shredded because of the shrinking effects of distillation. The observation that both the machine peat to be distilled and the subsequently coked peat mass offer no resistance to flush gases is very significant from a technological viewpoint; it points to the fact that there is no dust formation during the coking process.

The data obtained from the immediate analysis relating to peat coke from Kalocsa are as follows:

	Percent
Moisture content	0.00
Ash	24.43
Combustible substances	75.57
Coke	84.27
Fixed carbon	59.84
Volatile matter	15.73

Machine peat with a diameter of about 60 millimeters was fed into the experimental plant; because of the shrinkage during coking, the product was the nut size. For large plants, feeders must be constructed which will permit the use of peat in larger pieces resulting in coke of larger size.

The gases escaping from the distilling system have a heat value of about 1,200 calories; these gases have the following composition:

	Percent
CO_2	12 - 14
CO	5 - 7
CH_4	5 - 8
H_2	10 - 14

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Apart from the insignificant amount of heavy hydrocarbons, the gas also contains nitrogen.

In connection with peat coking, mention should be made of discussions held with the Mining Research Institute regarding the mechanization of domestic peat production. According to the opinions voiced by foreign experts visiting Hungary, peat briquettes are also suitable for coking. The peat briquette submitted was a completely satisfactory product; using the foreign working methods, peat briquettes have been manufactured by pressures of 2,000 kilograms per square centimeter.

Peat is an excellent basic substance for the production of active hard coals. The Research Institute for the Heavy Chemical Industry carried on extensive studies, especially with the fibrous peats of Feketebezseny /Somogy Megye/, with a view toward producing active hard coal. Laboratory experiments yielded satisfactory results.

In connection with peat distillation, mention should also be made of the problem of obtaining bitumen or wax, respectively, from peat or tar products through extraction with solvents. Waxes are indispensable basic materials in the manufacture of leather and auxiliary products in the textile industry and considerable quantities are required by a country with highly developed industries. For instance, peat wax is suitable for the manufacture of high-quality leather-preserving materials, while oxidized waxes might be used for the manufacture of ester waxes. The amount of raw bitumen obtained through the use of solvents varies between 5 and 10 percent, depending on the quality of the peat. The finished product is manufactured from raw waxes by means of physicochemical processes.

In treating the peat with lye instead of with organic solvents, a brown-colored substance known under the general name of humic acid is extracted. Humic acids derived from peat are apparently amorphous compounds, formed in peat especially from derivatives of vegetable matter as a result of chemical and organic changes.

Numerous suggestions have been made concerning the practical application of humic acid. For instance, humic acid solutions can be used for changing the physical properties of suspensions containing mineral substances or muds containing mineral colloids. Thus peat alkali extract has been successfully used in petroleum mining to reduce the viscosity of rinsing muds. By adding a solution containing a low percentage of humic acid to the mixture used for manufacturing cement which contains 25 to 30 percent water, the viscosity of the mud is decreased to an extent equal to raising its water content 35 to 45 percent. With this method the power required for the mud mixture can be reduced 12 to 20 percent; furthermore, the amount of coal required for burning out the cement mud may likewise be reduced 12 to 15 percent. The Silicon Division of the Research Institute for the Heavy Chemical Industry has also conducted experiments on this subject and has made similar findings. It would be desirable for such experiments to be repeated under actual operating conditions prevailing in cement plants.

The quantity of humic acid which can be dissolved from domestic peats depends on the quality of the basic material and on the extent of decomposition of the peat. Generally about 60 percent of the substance is dissolved in the form of humic acid from domestic peats of average decomposition.

In 1950, a contest was announced by the Hungarian government to devise a method of manufacturing insulating sheets from domestic raw materials. J[illegible]s Albert, the winner of the competition, produced insulating sheets of excellent

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quality from fibrous peats of Magyarovar. Albert retted the fibrous peat of Magyarovar in liquid phenolic resin solutions; the retted material was then poured upon filtering surfaces of suitable dimensions, drained, and then compressed. The molds were subsequently subjected to a mild heat treatment. The product thus obtained has excellent heat-insulating properties; its weight per liter does not exceed that of cork.

The chemical division of the Mining Research Institute also produced from peat a roof insulation of excellent quality, which will soon be placed on the market for industrial use.

In addition to the industrial utilization of peat, mention may be made of its use in agriculture. The agricultural division of the Peat Research Institute has already urged that peat be used in agriculture. Apart from the manufacture of manure from peat, which has been carried on for 30 years but is of local importance only, no suggestion has been made for the utilization of peat in agriculture. The agricultural division of the Peat Research Institute has been operating under the direction of the Mining Research Institute since the reorganization and is engaged in extensive experiments for improving sandy soils. In this connection, interesting experiments have been made under the direction of Sandor Herke, the well-known expert of alkaline soils, and by many others. Credit for these experiments is due to Laszlo Erdely, who initiated experiments to improve alkaline soils by the use of lignite dust or humic acid. Herke's experiments have revealed that alkaline soils can be improved by humic acid.

It is possible to produce organic manure rich in nitrogen by treating peat with ammonia, or simultaneously with ammonia and carbon dioxide at higher pressures and temperatures. An aminating process takes place in this case, with the humic acid reacting with the ammonia, and the ammonia with carbon dioxide.

Experiments involving attempts at changing peat substances into sugar for the manufacture of higher alcohols by means of suitable hydrolytic treatment also have agricultural implications.

COMMENTS

Laszlo Erdely, Mining Research Institute

Highly conflicting results have been obtained from experiments conducted with domestic peat manures. In tracing the causes of these discrepancies it has been established that mature domestic peats have low moisture-absorbing capacity; for this reason it has become necessary to locate peat of a minimum moisture-absorbing capacity, yet suitable for the production of peat manures.

Raw peat bran used in conjunction with artificial manures has increased the permanent humus content in sandy soil and performs the function of binding the soil particles. These results verify the theory that organic matter decays readily when mineral and vegetable matter is added during such decaying processes, and, on the other hand, they substantiate Soviet observation that organic matter is converted into permanent humus if it has previously undergone anaerobic decomposition. Peat is classified as such an organic substance.

Hungarian peat resources are very low; for this reason they must be treated economically. The permanent humus content of the domestic sandy soils can be maintained and fixed, under present conditions, by the use of artificial manure in conjunction with peat.

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Experiments conducted with peat extracts have revealed that these extracts destroy plant parasites to some extent; in other words, they exert a destructive action (humic acid) and also stimulate the growth of the plant and facilitate the development of tubercles of bacillus radicicola (fumaric acid). By treatment with hydrochloric acid, the solution was separated into two different components. Experiments have now been conducted with three different solutions.

Peat research work has been assigned the task of experimenting with the utilization of lignite dust in agriculture. This is due to the fact that the development of domestic lignite mining has produced lignite dust in large quantities which cannot be utilized in any other manner. Such experiments have already yielded very valuable results. Most important, it has been ascertained that lignite dust improves alkaline soils. As a consequence, lignite dust has ceased to be a useless by-product and Hungary is now in a position to improve alkaline-soda soils which have never before been amenable to treatment. Applied to other types of soil, lignite dust also facilitates plant growth and increases plant productivity. The most remarkable feature of these characteristics is that the volume of the plant cell tissue is increased. Research workers attribute the product-increasing the soil-improving actions of lignite dust to various properties, or effective substances, such as humic acid and nitrogen content. According to Professor H. Neubauer, humic acids also dissolve phosphorus and potassium present in the soil, while, according to the experimental findings of Prof Daniel Feher, the radioactive elements of lignite dust increase the cell tissue content of plants.

Zoltan Kabar

I would like to submit a few supplementary remarks based on unpublished findings of the Mining Research Institute.

With regard to the utilization of peat, the experts are divided between two extremes of opinion. One faction would prefer to direct our entire peat resources toward agricultural purposes, while the other faction would advocate the use of the entire quantity available for fuel. The correct solution lies between these two extreme concepts. The restricted amount of our peat resources must be used in its entirety for purposes to which it is most suited. There can be no arguing the fact that charcoal replacement, the manufacture of insulating materials, roof coverings, fine cardboard, replacement of lignite, sprinkling substances, etc., all represent the highest possible forms of utilizing peat.

The lack of fuel warrants the use of peat to some extent as fuel in the form of machine peat or peat briquette. There still remains a very large quantity to serve agriculture, for the simple reason that it is suitable for agricultural purposes exclusively. There are two principal aspects in the use of peat for agriculture: one is its use as peat-fecal manure, the other is its use as peat-artificial manure. Peat-fecal manure requires fibrous peat of great absorbent quality. Scrap of fibrous peat unsuitable for industrial processing may, therefore, be used for this purpose. On the other hand, some of the more mature peats have a high ash content (20 to 30 percent) and are, therefore, not suitable for fuel or other industrial purposes; at the same time, these peats make excellent substitutes for organic substances in the soil when admixed with artificial manure.

A central organization should ascertain which type of peat is best suited to a special purpose, and the enterprises in charge of exploitation should fill requirements on this basis. Furthermore, canalization and drainage of peat bogs should also be carried out in accordance with this production plan. It is a known fact that our peat resources are diminishing not only because they are set afire, but also because intensive plowing and improper canalization -- which lowers the ground-water level of the bogs -- produce "dead moorlands" in which peat, instead of decaying properly, merely degenerates. It is decomposed into carbon dioxide and water within a relatively short time, and its organic matter may disappear entirely. Estimating the amount of the decomposed matter at one centimeter per year, the loss equals 1,500 carloads of peat on a bog 10 square kilometers in area.

With respect to the ash content of peats, the results of recent detailed studies have revealed that the situation is better than had been thought. The average ash content of the Nadasladany deposit was found to be 13.3 percent and part of the Kecel deposit studied so far was found to be 15.6 percent. I would like to point out, for the sake of comparison, that the improved lignite of Varpalota has 12 to 14 percent of ash content.

Paper, textiles, or cotton cloth cannot be manufactured in sufficient quantities from domestic peats because we do not have fibrous moss peats. The peat found in the Hansag /Komarom Megye/ is fairly fibrous, but since the peat-forming plants growing there have a high silicic acid content, the fibers are rigid and brittle. But there is hope that these peats may be used as mixture in the manufacture of industrial wood or cardboard sheets.

Laszlo Ackermann, Professor of Chemical Technology, Budapest Technical University

One of the methods of economical peat production consists in using water-softening agents in the basic solutions. A simple and very economical process will produce an ion-exchanging solution of good quality which can be frequently regenerated. Compared with "permulite," produced also in Hungary, it does not have the disadvantageous property of permitting injurious silicic acid to penetrate into the boiler. This is an important factor in domestic industry, since ion-exchanging substances with artificial resin bases must be imported from abroad.

Gaspar Soltesz, Institute of Architecture

I shall give a brief description of experiments carried out by the Division of Chemistry of the Institute of Architecture, with respect to the utilization of peat for roof insulation. The manufacture of roofing substances was under the direction of the experimental laboratory of the Institute of Architecture. It has succeeded in developing a product somewhat more economical in use than in modern tar paper, despite the fact that the bitumen content is greater than ordinarily found in roof insulations. Nevertheless, the experiments are not considered hopeless, since there is no scarcity of bitumen. It is understood that all these experiments must be proved in practice.

Lajos Kreybig, Chemical Works Planning Enterprise

In connection with saturated gases produced in coking Hungarian coals, the simplest solution appears to be the manufacture of a gas containing 17 to 20 percent ammonia. I submit the question, in view of the fact that we are now engaged in solving the problem of coking Borsod lignite, of finding a method of utilizing such a gas, and I suggest that it may be along the line of saturating peat of lignite dust which may then be used as artificial manure.

Arpad Retezar

Replying to the question and objection, respectively, raised by Colleague Ackerman, I state that the Obuda Laboratoty of the Heavy Chemical Research Institute has also produced ion-exchanging substances from peat. However, lignite from Varpalota has been found to be a better basic material.

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